Household calculations

Carpets are normally sold to the required length from rolls having a width of 3 metres.

Question: What is the minimum length of carpet required to cover a room with dimensions of 5 metres by 8 metres. Assume that small cut pieces will be wasted.

Multiple choice:

a) 16 metres

b) 14 metres

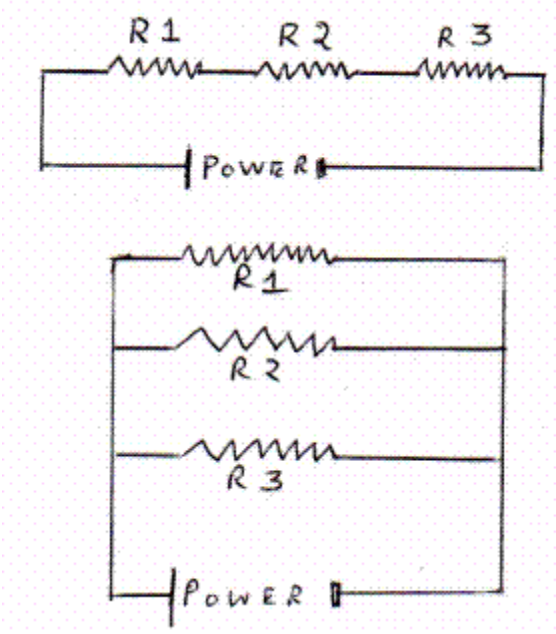
c) 13 metres

Correct answer is b) 14 metres

Electrical calculations

Electrical wiring in houses can be made in *series* or *parallel* circuits as shown in the sketch.

To know the current flowing through the circuit we need to know the total resistance of the circuit. All light bulbs or electrical heaters have resistance. The total resistance can be calculated using the appropriate formula.



Total resistance of a *series* circuit is the sum of the

resistances in the circuit, whereas the total resistance of a *parallel* circuit is the sum of its reciprocals. The equations are as follows:

Series Circuit

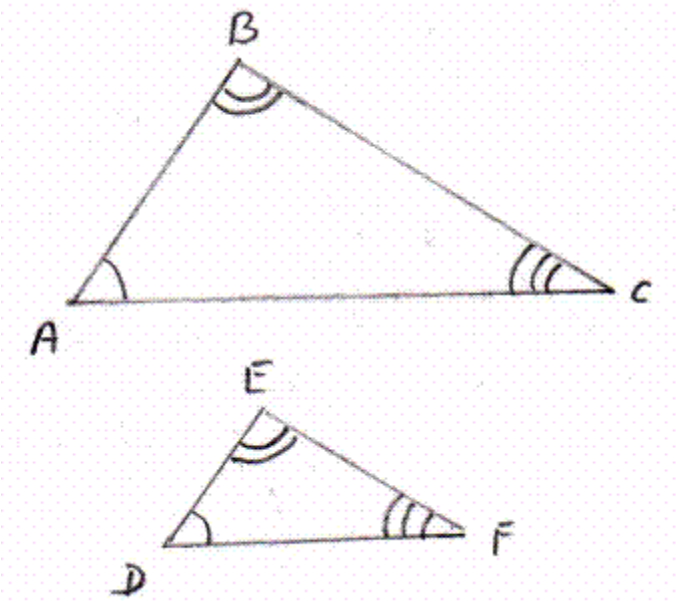
R = R1 + R2 + R3 + ... for a *series* circuit

and
1/R = 1/R1 + 1/R2 + 1/R3 +... for a *parallel* circuit

Parallel Circuit

Question: What is the total resistance of a parallel circuit consisting of two bulbs that have a resistance of 100 ohms each?

Answer: 50 ohms



Heights of buildings and towers

The principle of similar triangles can be used for this purpose. All the angles of *similar triangles* are equal. Corresponding sides need not be equal. Sides are *proportional* as given by the equation below:

AB/DE = AC/DF = BC/EF

Question : On a bright sunny day Gita decides to calculate the height of the CN Tower. She measures the length of the CN Tower's shadow on a flat ground to be 258.1 metres. At the same location and time she finds that the shadow cast by a 3 metre high lamp post is 1.4 metres. Can you approximately calculate the height of the CN Tower?

Method: Use the principle of similar triangles. 258.1 / 1.4 = (CN Tower Height) / 3

Answer is 553 metres

Temperature conversions

You must have seen temperature given as ^{o}F (Fahrenheit) or ^{o}C (Celsius) units. They can be converted using the formula:
Temperature in ^{o}C = (Temperature in ^{o}F - 32) * 5/9

Question: What is the approximate temperature setting in Celsius units of an oven thermostat set to 241^{o}F?

Answer: 116^{o}C

Efficiency of a power plant

Canadian nuclear reactors generate heat in a nuclear reactor which is converted partly into electrical power and the rest of heat is dumped into Lake Ontario.

Question: What percentage of thermal power is used for electricity production, if a nuclear reactor generates about 1200 MW of thermal power to produce about 500 MW of electric power?

Multiple choice: a) 42 % b) 58 % c) 50 %

Answer is a) 42 %

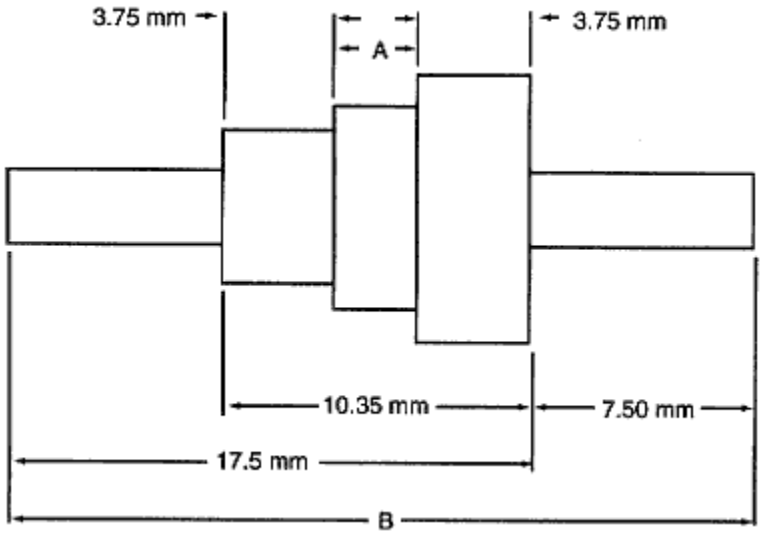
Capacity of a tank

Given the following formulae:
Area of circle = 22/7 * radius^{2}
Volume (m^{3}) = area * length
1 cubic metre (m^{3}) = 1000 litres

Question: Calculate the capacity (volume) of a cylindrical tank with flat ends which has a diameter of 3 meters and a length of 8 meters. Give the capacity to the nearest thousand litres.

Answer: 57 thousand litres

Dimensions in drawings



Question: What are the missing dimensions A and B?

Answer: A = 2.85 mm and B = 25 mm

Pollution limits

The regulatory limit of cyanide in waste water is 0.32 mg/litre

Question: An establishment dumps 1.4 million litres of water containing cyanide. What is the maximum number of grams of cyanide that may be legally dumped?

Answer: 448 grams

Acceleration of a car

Work = change in kinetic energy (KE) = 1/2 * mass * ((final velocity)^2 - (starting velocity)^2)
Power (watts) = work / time
1 horsepower (hp) = 746 W (watts)

- mass is in kg
- time is in seconds
- velocity is in metres/second

Question: A car manufacturer advertises that their most recently designed 1200 kg sports car can accelerate from rest to a velocity 25 metres/second in eight seconds. Assuming no losses, what is the average horsepower this car has to produce to achieve this acceleration?

Answer: 63 hp